A New Egg Sampling Plan for Pink Bollworm Reduced Insecticide Use by 35 Percent

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Abstract

During the past two years we developed an egg sampling plan for the pink bollworm (PBW) to provide a more accurate index of moth (target stage) activity than conventional larval sampling. The plan requires that only the presence or absence of eggs laid on bolls be determined to decide when insecticide treatments are needed. Our objective in 1986 was to determine whether egg sampling vs. conventional treatment criteria (e.g., larval infestations, trap catches of male moths, and/or fixed-spray intervals) provided more optimal timing of insecticide applications in a 640-ac field test. Implementation of the egg sampling method in 8 of the 16 fields resulted in an average 35 percent seasonal reduction in insecticide use when compared to conventional methods. Despite the reduction in insecticide use, PBW larval infestations were not significantly different ($P = 0.45$) in fields samples for eggs vs. fields sampled for larvae from June to September. Yields were also not significantly different ($P = 0.40$) between the two sets of fields.

Introduction

Based on preliminary studies in 1984 and 1985 on pink bollworm (PBW) egg and larval population dynamics, we hypothesized that egg sampling could provide a new monitoring tool that would encourage a 'spray-as-needed' philosophy for PBW management (Hutchison et al. 1986). Our rationale for evaluating egg sampling is that it provides the only recent index of female moth activity that can accurately be measured.

In 1986, we tested the possibility of using egg sampling as the primary tool for triggering insecticide applications for PBW in a large-scale pilot test. Evaluation of the egg sampling method was based on the amount of insecticide used, subsequent larval infestations and yields for fields managed by egg vs. larval sampling techniques.

Materials and Methods

The 1986 field test consisted of 16 commercial cotton fields in the Palo Verde valley, California, involving two growers, with 8 fields each and their respective pest control advisors (PCAs). All fields, ca. 40 ac. each, were planted to 'Deltapine 90' from 20-28 March. Of the total 16 fields, 8 were treated based on egg sampling (4/grower) using the procedures outlined in Hutchison et al. (1986). A treatment threshold of 6-8 percent infested bolls (i.e., bolls with one or more eggs) was used to determine when to treat.

The remaining 8 fields (4/grower) were treated using conventional larval sampling, trap catches of male moths and/or fixed spray intervals. Conventional treatment decisions were made by the growers' PCAs.

Beginning 16 June to 30 October, a total of 50 bolls were selected at random, in each of 4 quadrants, twice/week (N=200/field) to estimate PBW egg and larval infestations. For most of the season all 200 bolls were examined for eggs, where both percent and average egg density/boll were recorded. In September and October, however, due to higher egg counts, only 100 bolls were checked for eggs.

After egg infestations were recorded, and eggs removed from bolls, 100 bolls (25/quadrant) were 'cracked' to provide an immediate estimate of percent larval infestations, and 100 (25/quadrant) were held in ventilated plastic boxes at 75-85 F until larval emergence.

As part of the working agreement with the growers, PCAs and growers received egg and larval infestation data for the 8 egg-sampled fields as well as larval infestation data for the 8 larval-sampled fields. In addition, the PCAs received daily moth trap catch information for all 16 fields. These data were supplemental to the PCAs own independent monitoring procedures.

When insecticide treatments were necessary, various pyrethroids, usually Pydrin (fenvalerate) at 0.084 kg AI/ha, was applied (by air) alone, or in combination with chlordimeform (0.14 kg AI/ha). However, to minimize the development of resistance, we alternated pyrethroid materials with 1 to 3 applications/field of Azodrin (moncrotophos) at 0.70 kg AI/ha in late July and August. In late August and September, Ambush (permethrin) at 0.084 kg AI/ha was also used with or without chlordimeform. All applications were made from 7 p.m. to 2 a.m., the same day samples were taken.

Yield data (lint weight) were obtained for all 16 fields by hand-picking 8 sets (2/quadrant) of 6.5 row-feet/field.

RESULTS AND DISCUSSION

The seasonal average number of insecticide applications per field was significantly reduced 35 percent ($P<0.05$; $t = 2.71$, $df = 7$) in the fields which were monitored using the egg method (avg. = 5.4/field) vs. conventional larval sampling (avg. = 8.3/field) (Table 1). Given the fact that the PCAs received considerable information (e.g., larval infestation data) about all 16 fields twice/week, the test was not truly a 'blind' test and thus the 35 percent estimate is probably a conservative one.

Despite the significant reduction in insecticide use, there were no significant differences ($P>0.40$) in average percent larval infestations in the egg-sampled vs. larval-sampled fields (Table 2). This was true for each month, from June to September, as well as the average seasonal larval infestations. The average seasonal infestation level of 13.4 percent for all fields is higher than in previous years in the Palo Verde valley and reflects the higher than usual population pressure during 1986. This infestation level, however, is not considered to be an economically damaging level (e.g., Watson and Fullerton 1969).

We found no significant differences ($t = 0.40$, $df = 7$; $P = 0.41$) in lint weights for the egg- and larval-sampled fields. For the egg-sampled fields, we obtained an average of 1,650 lbs/ac. of lint (3.44 bales) and for the larval-sampled fields 1,666 lbs/ac. (3.47 bales).

Although treatment decisions based on egg sampling did not significantly contribute to yield increases (i.e., gross income), they also did not contribute to yield decline. Thus, a grower's profit margin (net income) should increase since insecticide input costs are reduced. Assuming a 35 percent savings in insecticide costs, and a typical annual bill of $200/Ac, "total farm" savings for farms ranging from 600 to 2,000 acres would be $42,000 to $140,000.

This study demonstrates that PBW egg sampling provides an improved technique, as compared to larval sampling, for deciding when to apply insecticides for PBW control. A 35 percent reduction in PBW insecticide cost, coupled with no significant reduction in yield, should result in an increase in growers' profit margins. Additional studies are planned for 1987 to implement an in-field presence-absence sequential sampling procedure for PBW eggs. This approach should reduce monitoring time and costs.

REFERENCES

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Table 1. Average number of pink bollworm insecticide applications per field (and total No.) for the 2 groups of 8 fields (egg vs. larval-sampling), Palo Verde, CA, 1986.

	Sampling Method				Egg Sample
	Egg-Sample		Larval-Sample		Reduction (%)
June	0.3	(2)	1.0	(8)	75
July	2.1	(17)	3.5	(28)	39
August	2.5	(20)	2.9	(23)	13
Sept.	0.5	(4)	0.9	(7)	43
Season	5.4[1]	(43)	8.3	(66)	35

1 Seasonal average number of treatments per field was significantly different ($P<0.05$; $t = 2.71$; $df = 7$) (paired t-test).

Table 2. Seasonal percent larval infestations in fields using egg vs. larval sampling.

	Percent Larval Infestation	
	Egg-Sampling1	Larval-Sampling
June	6.09	8.84
July	10.62	9.51
August	11.50	10.97
Sept.	23.38	26.28
Season	12.85	13.86
	Grand Mean = 13.4%	

1 No comparisons for each month or for the season were significantly different at the 5% level (paired t-tests).